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Sylvilagus cunicularius.

By Fernando A. Cervantes, Consuelo Lorenzo, Julieta Vargas, and Thorvald Holmes

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Sylvilagus cunicularius (Waterhouse, 1848)

Mexican Cottontail

Lepus cunicularius Waterhouse, 1848:132. Type locality "Sacualpan" (=Zacualpan).

Lepus verae-crucis Thomas, 1890:74. Type locality "Las Vigas, Jalapa."

Lepus insolitus Allen, 1890:189. Type locality "the plains of Colima, State of Colima, Mexico."

Sylvilagus cunicularius Nelson, 1909:239. First use of current name combination.

CONTEXT AND CONTENT. Order Lagomorpha, Family Leporidae, Genus *Sylvilagus*, Subgenus *Sylvilagus*. There are 14 extant species in the genus and three subspecies of *S. cunicularius* (Diersing, 1978; Hall, 1981):

S. c. cunicularius (Waterhouse, 1848:132), see above.

S. c. insolitus (Allen, 1890:189), see above.

S. c. pacificus (Nelson, 1904:104). Type locality "Acapulco, Guerrero."

DIAGNOSIS. The Mexican cottontail is the largest rabbit in México, equaling medium-sized jackrabbits in mass (Fig. 1). This species is also characterized by coarse pelage and massive skull. The fur is markedly softer than in the eastern cottontail (*Sylvilagus floridanus*), its sympatric congeneric. The color is dirty yellowish or grayish, without rufous, except on the nape, and the light subterminal rings on the hairs are uniformly pale cream-color (Thomas, 1890). The ears are about as long as the head, and their backs are thinly haired and gray with the extreme tips and outer edges darkening to black, but not as prominent as in the eastern cottontail.

The Mexican cottontail differs from the eastern cottontail primarily in having a larger skull (especially in greatest length) with a deeper mandible, larger auditory bullae, longer maxillary and mandibular toothrows, and greater breadth across the carotid foramina (Diersing and Wilson, 1980). The braincase is proportionally broader than in the following subspecies of the eastern cottontail rabbit: *S. f. aztecus*, *S. f. yucatanicus*, and *S. f. chiapensis*. The bullae are medium sized, proportionally about as in *S. f. yucatanicus* (Hall, 1981; Nelson, 1909). There is considerable similarity in general appearance between skulls of the Mexican cottontail and *S. floridanus yucatanicus*, but the supraorbital and postorbital processes of the Mexican cottontail are smaller and narrower, and the postorbital processes are less closely joined to the skull; the jugals are lighter; the teeth, both incisors and molars, are larger and heavier (Nelson, 1909). The Mexican cottontail and the eastern cottontail are parapatric and difficult to distinguish where the tropical coastal plain meets the western mountain slopes in the Mexican Pacific. Each species increases in overall size from southern Sinaloa southward to western Michoacán so that distinguishing between the two species is complicated (Diersing and Wilson, 1980).

GENERAL CHARACTERS. In fresh winter pelage, the top of the head is buffy brown, washed with black; the back is pale, buffy, yellowish gray darkened by overlaying long black hairs, and the color of the ears is similar to that of the top of the head, becoming blackish on the outside at the tips. The orbital area is a clear, deep buff; the sides of the head are a dark, dingy buff, and the nape is a dull rusty rufous. The forelegs are similar in color to the nape, but duller, less rufous; the hind legs and sides of the hind feet are duller, more rusty brownish than the forelegs; the tops of the hind feet are buffy whitish or pale, dull rusty. The line along the lower side of the flanks between the front and the hind legs is dull, rusty buff; the underside of the neck is a lighter shade of the same color; the rest of the underparts are dingy whitish (Nelson, 1909). The tail is short, and grayish brown above. The hairs on the tail and on the rump in front of it are slaty basally and yellowish brown terminally; the under surface is pure white (Hall, 1981; Nelson, 1909; Thomas, 1890).

The skull is large, heavy and broad across the braincase (Fig. 2). The rostrum is heavy with a massive base, flattened in the frontal region and arched along the upper outline; the nasals are sharply compressed into a dorso-lateral pit-like indentation about one-third of the distance from the tip and expand again towards the tip. The anterior edge of the palatal bridge is level with the front of the anterior premolar and its posterior edge is level with the division between the last premolar and the first molar (Hall, 1981; Nelson, 1909; Thomas, 1890). The jugals are proportionally light and slightly grooved with a deep pit anteriorly. The supraorbital process is light and narrow and but slightly raised above the plane of the frontals; the postorbital process is usually joined to the skull posteriorly enclosing a narrow flattened-oval foramen. The interparietal is triangular shaped, its antero-posterior length is nearly two thirds its transverse diameter, and the occipital shelf is unusually broad. The ventral borders of the rami of the lower jaws usually sit on the posterior angle and tip when resting on a plane, leaving the middle free; in skulls of old individuals the middle ventral border outline sometimes becomes convex, raising its tip (Nelson, 1909; Thomas, 1890). The dental formula is i 2/1, c 0/0, p 3/2, m 3/3, total 28.

Average measurements (in mm) of five adults from Las Vigas, Veracruz, are: total length, 511.6; length of tail vertebrae, 67.8; length of hind foot, 109.4; length of ear from notch in dried skin, 74.4; basilar length, 62.3; length of nasals, 36.4; breadth of rostrum above premolars, 21.2; depth of rostrum in front premolars, 17.0; interorbital breadth, 19.4; parietal breadth, 29.3; diameter of bullae, 11.4 (Nelson, 1909). Other measurements include: length of lower jaw, bone only, 65, to incisor tips, 68; height from condyle to antero-inferior corner of angular ridge, 43; length of the ridge, 31 (Thomas, 1890). Ranges reported for external measurements (in mm) are: total length, 485–515; length of tail, 54–68; length of hind foot, 108–111; length of ear from notch (dry), 60–63 (Hall, 1981). However, Leopold (1972) reported a range of 70–75 mm for the length of ear from notch. Most of the geographic variation found in this cottontail is due to size (Diersing and Wilson, 1980).

Mexican cottontails from the Sierra Madre of Michoacán, in the western part of their range, are slightly larger in both skin and skull dimensions than those from elsewhere, but there are no color differences. In worn pelage, the general color becomes paler and more of a dingy, yellowish gray. Considering the wide range of this species under varied climatic conditions, the amount of variation is surprisingly small (Nelson, 1909).

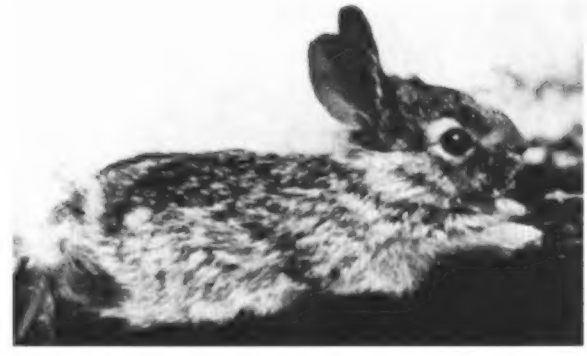

FIG. 1. Photograph of a young female Mexican cottontail (*Sylvilagus cunicularius*) from Parrés, 33 km S Mexico City, Distrito Federal, 3,000 m.

FIG. 2. Dorsal, ventral, and lateral view of the skull, and lateral and dorsal view of the mandible of *Sylvilagus cunicularius cunicularius* (adult male, Instituto de Biología, Universidad Nacional Autónoma de México, 16525) from Parrés, 33 km S Mexico City, Distrito Federal, 3,000 m. Greatest length of skull is 88.1 mm.

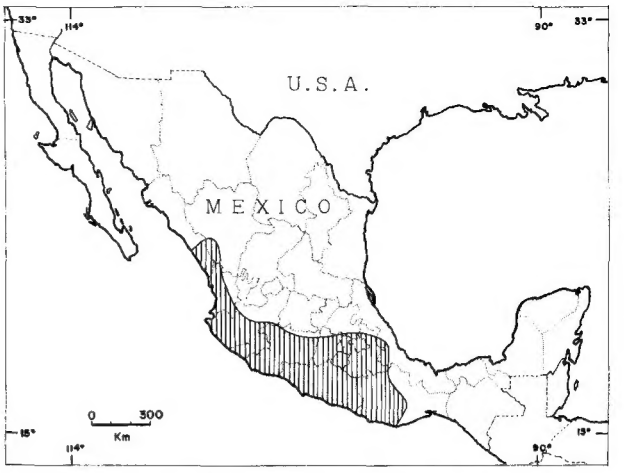

FIG. 3. Geographical distribution of the Mexican cottontail, *Sylvilagus cunicularius* (after Hall, 1981).

DISTRIBUTION. The Mexican cottontail is an endemic species ranging along the Pacific coastal plain from Sinaloa south to Oaxaca, México (Fig. 3). The range extends east along the Transverse Volcanic Axis, from the highlands of Michoacán to Veracruz (Alvarez et al., 1987; Diersing and Wilson, 1980; Hall, 1981). *S. cunicularius* occurs from sea level to near 3,500 m of altitude.

FOSSIL RECORD. There are few known fossils of this species. A broken skull and two right dentaries (one with no teeth) from the Pleistocene have been collected at "Barranca Seca," 3 km E Acultzingo, Veracruz. It is thought that the remains were deposited when the environment was tropical (Dalquest, 1961). A calcaneum of the Mexican cottontail was reported from Tlapacoya, in the state of México (Alvarez, 1969). The bone was 26.4 mm long and 11.3 mm wide, and dated from near 12,000 years ago. Several ±2,000-year-old bone remains were recorded at "Terremote-Tlatenco," in the southern Valley of México. The abundance of this fossil material suggests intense use of *S. cunicularius* as food by ancient human inhabitants of the region (Serra and Valadez, 1986).

FORM AND FUNCTION. The comparative anatomy of the muscles involved in mastication among the zacatuche rabbit (*Romerolagus diazi*), the eastern cottontail rabbit, and the Mexican cottontail produced evidence on their systematic relationships (Alvarado, 1983). Between the Mexican cottontail and the zacatuche rabbit: the muscles masseter superficialis, masseter lateralis profundus (pars posterior), and masseter medialis (pars anterior) showed different origin, the muscles masseter superficialis, masseter lateralis profundus (pars anterior and pars posterior), and temporalis displayed different insertion, and the muscles masseter lateralis profundus (pars anterior) and masseter medialis (pars anterior and pars posterior) were different in structure; the pterigoideus externo and pterigoideus interno were similar. The masseter superficialis, masseter lateralis profundus (pars posterior), and temporalis had different insertion in the Mexican cottontail and the eastern cottontail rabbit, while only the masseter medialis (pars anterior) showed a different structure. The masseter lateralis profundus (pars anterior), masseter medialis (pars posterior), pterigoideus externo, and perigoideus interno shared similar structure between these two species. Therefore, the comparison of the masticatory muscles indicates that the Mexican cottontail is more like the eastern cottontail rabbit than either of these two species is like the zacatuche rabbit. Furthermore, the muscles of mastication of the zacatuche rabbit differ more from those of the Mexican cottontail than they do from those observed for the eastern cottontail rabbit (Alvarado, 1983).

ONTOGENY AND REPRODUCTION. A male taken at Monte Río Frío, in the state of México, on 27 June was a half-grown young; a female collected a day later contained 5 large embryos, suggesting at least two breeding periods a year (Davis, 1944). Data from Guerrero show that although the testes of males taken in June were enlarged (23–27 mm), none of the females taken was pregnant (Davis and Lukens, 1958). However, a female taken 3 August was lactating (Davis, 1944). Additionally, two lactating females were recorded near Tecpan on 23 February and 2 March, respectively; one of them contained two embryos, one was 78 mm long in the left uterine horn and the other 70 mm in the right side (Ramírez-Pulido et al., 1977). A female from near La Concha, Sinaloa, on 25 October was lactating and carried three embryos, 58

mm in crown–rump length (Armstrong and Jones, 1971). Two males from Morelos, one from the boreal forest and the other from the lowlands, were in breeding condition (28 July and 12 August, respectively; Davis and Russell 1954). Conversely, it was suggested that the Mexican cottontail from the highlands of the Valley of México breeds throughout the year, each female producing up to six newborn several times a year; the gestation period is about 30 days (Ceballos and Galindo, 1984).

ECOLOGY. The Mexican cottontail occurs in arid lowlands as well as in temperate highlands. This pattern is shared with just a few other mammal species in Morelos, which display wide ecological tolerance (Davis and Russell, 1954). The Mexican cottontail selects zones of grasses and herbs within this range. Similarly, in the state of Guerrero, *S. cunicularius* is characteristic of the interior upland valleys of both the tropical deciduous and pine-oak zones. It has been taken in arid situations between altitudes of 823 m and 1,707 m and to over 2,134 m in Omiltemi (Davis and Lukens, 1958). The range of *S. c. pacificus* in Guerrero is the narrow coastal area below an elevation of 457 m. In the Mexican Transvolcanic Belt it inhabits forests of pine and oak-pine with understory of clumped grasses. It rarely has been seen within conifer forests of "Oyamel" (*Abies religiosa*; Ceballos and Galindo, 1984). This cottontail has been taken up to 3,353 m at Pico de Orizaba Volcano, Veracruz (Nelson, 1909).

The Mexican cottontail shares its habitat with other leporids. In the highlands of central Mexico, this rabbit was common in openings in the pine forests covered by clumped grass where it occurred in association with the zacatuche rabbit and the eastern cottontail (Aranda et al., 1980; Ceballos and Galindo, 1984; Cervantes, 1980; Davis, 1944; Leopold, 1972; Nelson, 1909; Ramírez-Pulido, 1969). On the borders of the adjacent plains this cottontail occurs with *S. auduboni parvulus* and the jackrabbits *Lepus callotis* and *L. californicus festinus*. *L. callotis* also is sympatric with the Mexican cottontail in Guerrero (Davis and Lukens, 1958). *S. cunicularius* occurs with *S. floridanus* in the coastal lowlands of southern Sinaloa (Armstrong and Jones, 1971).

Mexican cottontails from central México feed on clumped grasses including *Muhlenbergia macroura*, *Stipa ichu*, and *Festuca amplissima* (F. A. Cervantes, pers. obs.). They select tender shoots of grasses, young leaves of forbs, cortices of shrubs, and cultivated plants such as oats (*Avena sativa*), maize (*Zea mays*), and barley (*Hordeum vulgare*; Ceballos and Galindo, 1984; Ceballos and Miranda, 1986).

Fecal pellets of *S. cunicularius* are regularly found next to the bases of grasses. Fecal pellets of adult individuals are characteristic and are rarely confused with those from other sympatric leporids. Each pellet is ochraceous, rounded, swollen in the center, and reaches 15 mm in diameter. Adult zacatuche rabbits and eastern cottontail rabbits always produce smaller fecal pellets. Fecal pellets of the Mexican cottontail accumulate in dung hills and each accumulation lies at least 20 m from the next (Aranda et al., 1980; Cervantes, 1980).

Tracks of the forefeet and hind feet display four toes, although the forefeet bear a fifth toe. Forefeet are 4.0 cm long and 2.0 cm wide on average, while hind feet are 5.5 cm and 2.0 cm long, respectively. The track pattern of the Mexican cottontail is similar to other leporids: forefoot tracks lie next to each other and ahead of the hind foot tracks, which lie one ahead of the other (Aranda et al., 1980).

The most important predators of the Mexican cottontail in the coastal region of Chamela, Jalisco, are mammalian carnivores, some birds, and, occassionally, snakes (Ceballos and Miranda, 1986). In the highlands of the Valley of México, young Mexican cottontails are preyed upon by *Tyto alba* and *Buteo* spp. while adults are taken by *Urocyon cinereoargenteus*, *Canis latrans*, and, especially, *Lynx rufus* (Ceballos and Galindo, 1984).

Hunting of the Mexican cottontail for food and sport is common (Ceballos and Galindo, 1984; Leopold, 1972). The Mexican cottontail was a common mammal near the coast of Chamela, Jalisco, until a few years ago. However, at present it is rare in the area. Local residents claimed the populations of Mexican cottontails declined due to hunting (Ceballos and Miranda, 1986). Similarly, *S. cunicularius* is no longer abundant in Morelos after intensive hunting by residents (Davis and Russell, 1954).

BEHAVIOR. Mexican cottontails are solitary and active mainly at dusk and at dawn, although they may be active at night and during the day (Ceballos and Miranda, 1986). Mexican cottontails from the highlands of central Mexico have been collected in abandoned burrows of pocket gophers (*Pappogeomys merriami*) and in natural rocky hollows and crevices on and underneath the ground (F. A. Cervantes, pers. obs.).

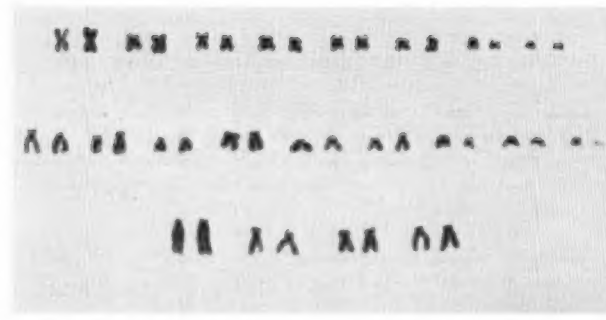

FIG. 4. Karyotype of a female *Sylvilagus cunicularius cunicularius* (adult, Universidad Autónoma Metropolitana, Iztapalapa, 8226) from Parrés, 33 km S Mexico City, Distrito Federal, 3,000 m.

GENETICS. A shared common ancestor and biogeographic and morphological affinities have been hypothesized between the Mexican cottontail rabbit and the Tres Marías Islands rabbit (*S. graysoni*; Diersing and Wilson, 1980). The diplod number of both species is 42, supporting the hypothesis of close relationship (Lorenzo, 1987). Including both autosomes and sex chromosomes, there are eight pairs of small to medium metacentric chromosomes, nine pairs of small to medium submetacentric chromosomes, and four pairs of medium to large acrocentric chromosomes (Fig. 4). The fundamental number and morphology of the sexual chromosomes are unknown since only females were examined. Chromosome pairs 10, 11, and 15 bore satellites; no secondary constrictions were observed. Few differences were recorded when karyotypes were compared with sympatric individuals of *S. floridanus* (Lorenzo, 1987). Cells of the eastern cottontail showed two more metacentrics and three less submetacentrics; furthermore, the satellites were observed on different pairs of submetacentrics.

REMARKS. The Mexican cottontail is known as *conejo montés* (mountain rabbit) in Central México and *conejo* elsewhere in México. The type specimen was collected by Deppe and is housed in the Berlin Museum (Nelson, 1909). Waterhouse published the description of the Mexican cottontail based upon notes communicated to him by Bachman (Nelson, 1909). Waterhouse used the name *cunicularius* which Lichtenstein had placed on the labels of the specimens (Osgood, 1907). Osgood examined these Mexican cottontails and they proved to be identical with the species described as *Lepus veraecrucis* by Thomas (Nelson, 1909). Taxonomic, morphological, karyological, and biogeographic evidence support the view that *S. graysoni*, endemic to the Tres Marías Islands, shared a common mainland ancestor with the Mexican cottontail, and was separated from it at a time when the islands were closer to, or attached to the mainland (Diersing and Wilson, 1980; Lorenzo, 1987). Hunters actively seek the Mexican cottontail by its large size and they prefer it over the eastern cottontail and the zacatuche rabbit wherever the three leporids coexist.

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Editors of this account were TROY L. BEST, GUY N. CAMERON, and KARL F. KOOPMAN. Managing editor was CRAIG S. HOOD.

F. A. CERVANTES, C. LORENZO, and J. VARGAS, DEPARTAMENTO DE ZOOLOGÍA, INSTITUTO DE BIOLOGIA, UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO, APARTADO POSTAL 70-153, MÉXICO, DISTRITO FEDERAL 04510; T. HOLMES, MUSEUM OF NATURAL HISTORY, UNIVERSITY OF KANSAS, LAWRENCE, KANSAS 66045.